

**Technical and Professional**

# **Curriculum Content Frameworks for Drafting and Design**

**Curriculum Content Frameworks for  
Drafting and Design  
Developed by the  
University of Arkansas at Little Rock**

**State of Arkansas  
Department of Workforce Education**

## **NOTICE TO THE READER**

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## **Preface**

The T&I program continues to prepare students for employment and continuing education. To accomplish this preparation, teachers and employers have collaborated to modify individual programs to ensure that instruction is current and comprehensive. This document reflects essential competencies for program completers as well as All Aspects of the Drafting and Design Industry as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all T&I programs can be accessed through the Department of Workforce Education Web site.

## Forward

The curriculum content framework *Drafting and Design* supports the course that prepares students for the following career roles, which in turn correspond to the CIP (Classification of Instructional Programs) codes listed below. The courses may be sequenced with a variety of career and technical courses to form a specialization to prepare students for careers and support additional education and training in the Drafting and Design services industry.

- Career Family: Architecture and Construction
- Career Area: Architecture & Construction Design
- Career Role CIP Code
- Architecture Design 40201
- Architectural Drafting and Architectural CAD/CADD 151303
- Civil Drafting and Civil Engineering CAD/CADD 151304
- Career Family: Scientific Research and Engineering
- Career Area: Engineering Technologies
- Career Role CIP Code
- Drafting/Design Engineering Technology/Technician 151301
- CAD/CAM Design Application Technology/Technician 151302
- Architectural Drafting 480102
- Civil/Structural Drafting 480103
- Electrical/Electronic Drafting 480104
- Mechanical Drafting 480105
- O-NET – 17-3011.XX  
17-3012.XX

# **Acknowledgments**

The Drafting and Design curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock. The framework was reviewed by a panel of experts in the field of Drafting and Design. The format and content of the framework reflect the specific training needs within the state. The framework content and format is modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education for granting the Arkansas State's Department of Workforce Education access to their instructional frameworks.

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# **Introduction**

## **About the Course**

Drafting and Design provides students with communications and graphics skills for use in industries such as architecture, engineering, and manufacturing. The course sequence focuses on career-development skills, as well as duties and tasks performed by professionals in drafting and design occupations. Students who complete this course complete a specialization in Drafting. Drafting has National Standards developed by the professional organization, American Design Drafting Association (ADDA). Duties and tasks taught in Drafting and Design have been correlated to the American Design Drafting Association's Drafter Certification exam. More information about the Drafter Certification exam can be found on ADDA's website at <http://www.adda.org/drafter/drafter.htm>.

## **About the Document**

The document includes the following components:

- Section 1 contains a master duty/task list for Drafting and Design Technology program.
- Section 2 contains an analysis of each task, consisting of the task, task definition, and process/skill questions to evaluate acceptable performance
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in Drafting and Design Technology program. Academic skills in these areas are necessary for the mastery of a number of tasks performed by drafting and design technicians on the job.



## **Program Description**

47.050 – Drafting and Design

47.051 – Architecture/CADD I

47.053 - Architecture/CADD II

47.054 – Engineering/CADD I

47.056 - Engineering/CADD I

Drafting and Design provides students with communications and graphics skills for use in industries such as architecture, engineering, and manufacturing. The course sequence focuses on career-development skills, as well as duties and tasks performed by professionals in drafting and design occupations. Students learn theory and the manipulative skills necessary to produce complete and accurate drawings based on the ideas and sketches of engineers, architects, and designers. They design and prepare mechanical, structural, and architectural plans.

## Master Duty/Tasks Listing Drafting and Design

Drafting and Design  
Architecture/CADD I  
Architecture/CADD II  
Engineering/CADD I  
Engineering/CADD II

National and state experts in the occupational field of Drafting and Design have validated the duties and tasks in this section. Each is analyzed by identifying the following:

- a *duty/task statement*, which describes what the student is to do

<b>DUTY A:</b> <b>Practicing Safety</b>
<b>Task:</b>
A001: Follow general safety procedures.
A002: Adjust equipment for maximum comfort and usability.
A003: Describe ergonomic considerations.
<b>DUTY B:</b> <b>Preparing for a Career in Drafting</b>
<b>Task:</b>
B001: Describe career options.
B002: Identify educational experience and personal traits that benefit a drafter.
B003: Describe potential barriers to career advancement and strategies for removing them.
B004: Participate in SkillsUSA–VICA activities.

<b>DUTY C:</b> <b>Getting Oriented to Drafting</b>
<b>Task:</b>
C001: Describe various types of drawings.
C002: Care for basic drafting equipment and tools.
C003: Use basic drafting equipment and tools.
<b>DUTY D:</b> <b>Using Mathematics in Drafting</b>
<b>Task:</b>
D001: Perform metric-U.S. system conversions.
D002: Perform conversions within a measurement system.
D003: Apply basic mathematical skills to drafting operations.
D004: Apply mathematical calculations involving practical geometry and trigonometry.
<b>DUTY E:</b> <b>Performing Basic Drafting Operations</b>
<b>Task:</b>
E001: Demonstrate techniques of scale usage.
E002: Prepare freehand sketches.
E003: Perform freehand lettering.
E004: Apply line conventions.
E005: Adjust manual drafting equipment.

E006: Apply geometric construction principles.
E007: Prepare orthographic projections.
E008: Create pictorial views from orthographic projections.
E009: Dimension mechanical drawings.
E010: Revise existing drawings.
E011: Prepare sectional views.
<b>DUTY F: Performing Basic CADD Operations</b>
<b>Task:</b>
F001: Identify basic components of a CADD system.
F002: Perform fundamental computer skills.
F003: Use CADD setup commands.
F004: Use CADD drawing commands.
F005: Use CADD modifying commands.
F006: Use CADD dimensioning commands.
F007: Use CADD 3-D modeling commands.
F008: Use CADD file commands.
F009: Prepare basic CADD drawings.

<b>DUTY G:</b> <b>Performing Mechanical Drafting and Design Operations with Extensive Use of CADD</b>
<b>Task:</b>
G001: Prepare auxiliary views.
G002: Prepare drawings of threads and fasteners.
G003: Reproduce bluelines.
G004: Use reference materials.
G005: Use basic drafting standards.
G006: Add general notes to a drawing.
G007: Develop patterns, including radial and parallel line patterns.
G008: Select the appropriate types of projections to represent objects.
G009: Apply mechanical symbols to a drawing.
G010: Prepare detail and assembly working drawings.
<b>DUTY H:</b> <b>Performing Architectural Drafting and Design Operations with Extensive Use of CADD</b>
<b>Task:</b>
H001: Describe key developments in the history of architecture.
H002: Identify the basic principles behind codes.
H003: Apply architectural symbols to a drawing.
H004: Identify items that comprise a set of working drawings.

H005: Design a site plan.
H006: Prepare a site plan.
H007: Design a floor plan.
H008: Prepare a floor plan.
H009: Design a foundation/basement plan.
H010: Prepare a foundation/basement plan.
H011: Design a wall section plan.
H012: Prepare a wall section plan.
H013: Design an electrical plan.
H014: Prepare an electrical plan.
H015: Design a plumbing plan.
H016: Prepare a plumbing plan.
H017: Design a window and door schedule.
H018: Prepare a window and door schedule.
H019: Design kitchen cabinets and bath vanities.
H020: Prepare kitchen cabinet and bath vanity details.
H021: Design a set of stairs.

H022: Prepare a detail drawing of a set of stairs.
H023: Design a fireplace.
H024: Prepare a detail drawing of a fireplace.
H025: Design elevations.
H026: Prepare elevations.
H027: Dimension architectural drawings.
H028: Estimate material quantities.
H029: Prepare a rendered presentation drawing.
H030: Build a presentation model.
H031: Prepare a cover sheet.
<b>DUTY I: Preparing a Career Portfolio</b>
<b>Task:</b>
I001: Plan a portfolio.
I001: Gather material for a portfolio.
I001: Organize a portfolio.
I001: Present a portfolio.

# Task Definitions

. National and state experts in the occupational field of Drafting and Design have validated tasks in this section. Each task is analyzed by identifying the following:

- a *task definition* (criteria for acceptable performance), which explains what the student has to do to perform the task at the expected level of mastery
- *process/skill questions*, which assess student knowledge and performance.

Tasks are arranged by instructional duty area only. The placement of tasks into specific courses and the sequencing of tasks for instruction are local decisions based on student needs, employer demand, and school schedules.

<b>DUTY A:</b>
<b>Practicing Safety</b>
<b>Task:</b>
<p><b>A001: Follow general safety procedures.</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• safe handling of all tools, equipment, and furniture</li> <li>• adherence to safety precautions regarding CADD electrical equipment</li> <li>• adherence to classroom regulations</li> <li>• familiarity with school emergency plans</li> </ul> <p>Process/Skill Questions:</p>
<p><b>A002: Adjust equipment for maximum comfort and usability.</b></p> <p><i>Definition:</i> Process should include adjustments to the following:</p> <ul style="list-style-type: none"> <li>• computer monitor</li> <li>• drawing table</li> <li>• lights</li> <li>• chair</li> </ul> <p>Process/Skill Questions:</p>
<p><b>A003: Describe ergonomic considerations</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Describe comfort, fatigue, and health-related concern considerations such as: <ul style="list-style-type: none"> <li>- keyboard position</li> <li>- chair position</li> <li>- screen position</li> <li>- lighting levels</li> <li>- position of arms, wrists, and hands when using equipment</li> </ul> </li> </ul> <p>Process/Skill Questions</p>



**DUTY B:**  
**Preparing for a Career in Drafting**

**B001: Describe career options**

*Definition:* Process should include the following:

- describe career options of an architect, draftsman, engineer, industrial designer, model maker, teacher, technical illustrator, and tool designer

Process/Skill Questions

**B002: Identify educational experience and personal traits that benefit a drafter**

*Definition:* Process should include the following:

- complete a high school level Trade and Industry program
- study in a community college program
- develop attention to detail
- explore interest in mechanics and construction

Process/Skill Questions

**B003: Describe potential barriers to career advancement and strategies for removing them.**

*Definition:* Process should include the following:

- discuss failure to meet workplace expectations (i.e., conduct, performance)
- discuss failure to keep current with technical knowledge and skills
- discuss workplace discrimination (based upon such factors as gender, ethnicity, age, or physical disability)
- learn state and federal employment laws and company human resources policies
- participate in professional development programs
- participate in employee association and/or union services
- appreciate the benefits of constructive criticism

Process/Skill Questions

**B004: Participate in SkillsUSA–VICA activities.**

*Definition:* Process should include the following:

- attend meetings
- be involved in projects and activities
- compete in events

Process/Skill Questions

**DUTY C:**  
**Getting Oriented to Drafting**

**Task:**

**C001: Describe various types of drawings.**

*Definition:* Process should include the following:

- identify basic components of the following types of drawings:
  - architectural
  - civil
  - mechanical

Process/Skill Questions

**C002: Care for basic drafting equipment and tools.**

*Definition:* Process should include the following:

- care for drafting equipment and tools per manufacturers' and teacher's specifications
- clean equipment and tools and store securely after daily use

Process/Skill Questions

**C003: Use basic drafting equipment and tools.**

*Definition:* Process should include the following:

- use basic drafting tools and equipment to include compass, dividers, drafting tape, drawing board, dusting brush, eraser, erasing shield, French curve, pencil, pencil pointer, protractor, scale, triangles (45° and 30°/60°), and T-square

Process/Skill Questions

**DUTY D:**  
**Using Mathematics in Drafting**

**Task:**

**D001: Perform metric-U.S. system conversions.**

*Definition:* Process should include the following:

- convert millimeters to inches, inches to millimeters, meters to feet, and feet to meters
- round conversions to the nearest whole unit

Process/Skill Questions

**D002: Perform conversions within a measurement system**

*Definition:* Process should include the following:

- convert units of measurement within a given system to include calculations that convert
  - inches to feet and feet to inches
  - millimeters to centimeters and centimeters to millimeters

Process/Skill Questions

**D003: Apply basic mathematical skills to drafting operations.**

*Definition:* Process should include the following:

- apply addition, subtraction, multiplication, and division involving
  - whole numbers
  - fractions
  - mixed numbers
  - decimals
- convert fractions to decimals and decimals to fractions

Process/Skill Questions

**D004: Apply mathematical calculations involving practical geometry and trigonometry.**

*Definition:* Process should include the following:

- apply practical geometry and trigonometry using the Pythagorean Theorem (3-4-5 triangle), Law of Sines, and formulas for area and volume

Process/Skill Questions

**DUTY E:  
Performing Basic Drafting Operations****Task:****E001: Demonstrate techniques of scale usage.**

*Definition:* Process should include the following:

make full-size, larger than full-size, and smaller than full-size measurements using the architect's scale, engineer's scale, mechanical drafter's scale, and metric scale

Process/Skill Questions

**E002: Prepare freehand sketches.**

*Definition:* Process should include the following:

- prepare rough and finished sketches requiring methods of sketching lines, geometric shapes and alphabet of lines

Process/Skill Questions

**E003: Perform freehand lettering.**

*Definition:* Process should include the following:

- construct numbers and large and small uppercase letters (The American National Standards Institute (ANSI) recommends use of the Single-Stroke Gothic Alphabet)

Process/Skill Questions

**E004: Apply line conventions.**

*Definition:* Process should include the following:

- apply object visible lines, hidden lines, section lines, center lines, dimension lines, extension lines, cutting-plane lines, phantom lines, short and long break lines, leaders lines, and border lines to sketches

Process/Skill Questions

**E005: Adjust manual drafting equipment.**

*Definition:* Process should include the following:

- adjust manual drafting equipment to improve usability to include drafting machine, parallel bar, T-square, and drafting table

Process/Skill Questions

**E006: Apply geometric construction principles.**

*Definition:* Process should include the following:

- apply geometric construction principles to include bisects lines, arcs, and angles, divide lines into equal parts, construct parallel and perpendicular lines, construct angles and triangles, construct tangent lines and arcs, construct polygons, and construct ellipses

Process/Skill Questions

**E007: Prepare orthographic projections.**

*Definition:* Process should include the following:

- prepare projections using glass box method (i.e., front, top, right-side, left-side, bottom, and rear views), multi-view drawings, positioning of views, line precedence, fillets, rounds, and runouts

Process/Skill Questions

**E008: Create pictorial views from orthographic projections.**

*Definition:* Process should include the following:

- create pictorial views using axonometric drawings (isometric, dimetric, and trimetric), oblique drawings (general, cavalier, and cabinet), and perspective drawings (one-point and two-point)

Process/Skill Questions

**E009: Dimension mechanical drawings.**

*Definition:* Process should include the following:

- apply units of measurement, line types, arrowheads, and leaders, placement of dimensions (e.g., unidirectional, aligned), and standards for applying dimensions to various geometric shapes

Process/Skill Questions

**E010: Revise existing drawings.**

*Definition:* Process should include the following:

- make changes and add a revision block to drawing

Process/Skill Questions

**E011: Prepare sectional views.**

*Definition:* Process should include the following:

- select type of sectional view best illustrating an object to include full sections, half sections, offset sections, broken-out sections, revolved sections, removed sections, aligned sections or features, rib sections, assembly sections, and pictorial sections

Process/Skill Questions

**DUTY F:**  
**Performing Basic CADD Operations**

**Task:**

**F001: Identify basic components of a CADD system.**

*Definition:* Process should include the following:

- identify basic components of a CADD system to include a CPU, monitor, keyboard, mouse, digitizer, plotter, printer, and software

Process/Skill Questions

**F002: Perform fundamental computer skills.**

*Definition:* Process should include the following:

- . open and close software applications
- . manage files (i.e., saving, backing up, organizing)
- . perform monitor and mouse configuration and setup

Process/Skill Questions

**F003: Use CADD setup commands.**

*Definition:* Process should include the following:

- use CADD setup commands to include limits, units of measurement, text styles and size, dimensioning variables, snap, o snap, and grid, layers and line types, and scale according to the software manufacturer's documentation

Process/Skill Questions

**F004: Use CADD drawing commands.**

*Definition:* Process should include the following:

- use CADD drawing commands to include lines, circles, arcs, polylines, polygons, ellipses, rectangles, text, and hatch according to the software manufacturer's documentation

Process/Skill Questions

**F005: Use CADD modifying commands.**

*Definition:* Process should include the following:

- use CADD modifying commands to include change, . move, copy, . mirror, chamfer, break, offset, fillet, stretch, scale, rotate, trim/extend, erase, text edit, explode, . grips, and array according to the software manufacturer's documentation

Process/Skill Questions

**F006: Use CADD dimensioning commands.**

*Definition:* Process should include the following:

- use CADD dimensioning commands to include linear, aligned, angular, baseline, continue, radius and diameter, leaders, associative dimensioning, and dimension styles according to the software manufacturer's documentation

Process/Skill Questions

**F007: Use CADD 3-D modeling commands.**

*Definition:* Process should include the following:

- construct solid primitives
- modify solid primitives
- view and display three-dimensional models
- shade and render
- apply materials
- apply lighting
- apply cameras
- use according to the software manufacturer's documentation

Process/Skill Questions

**F008: Use CADD file commands.**

*Definition:* Process should include the following:

- use CADD file commands to include new, save/save as, plot, import/export, open/close, and exit according to the software manufacturer's documentation

Process/Skill Questions

**F009: Prepare basic CADD drawings.**

*Definition:* Process should include the following:

- use basic CADD drawings to include scales, line types and line weights, geometrical constructions, pictorial drawings, orthographic projection, dimensions, and sectional views

Process/Skill Questions

<b>DUTY G:</b> <b>Performing Mechanical Drafting and Design Operations</b>
<b>Task:</b>
<b>G001: Prepare auxiliary views.</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• use primary auxiliaries, which illustrate height, width, and depth</li> <li>• use secondary auxiliaries, which illustrate oblique angles and oblique surfaces</li> </ul> Process/Skill Questions
<b>G002: Prepare drawings of threads and fasteners.</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• select types of thread and fastener callouts (metric and U.S. system)</li> <li>• select types of drawings (detailed, schematic, and simplified).</li> <li>• choose thread and fastener types based upon construction materials and situation</li> </ul> Process/Skill Questions
<b>G003: Reproduce bluelines.</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• set up blueline machine</li> <li>• follow safety measures</li> <li>• know which paper type and speed setting to use for specific situations</li> <li>• understanding general operations of blueline machine</li> </ul> Process/Skill Questions
<b>G004: Use reference materials.</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• demonstrate facility with table of contents, indexes, pagination, cross-references, and other specific features with reference materials to include ANSI manuals, ISO manuals, building code manuals, Sweets catalog, Thomas Register catalog, and machinist handbooks</li> </ul> Process/Skill Questions
<b>G005: Use basic drafting standards.</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• demonstrate ability to draft according to ANSI, ISO, DOD, and MIL standards</li> </ul> Process/Skill Questions



**G006: Add general notes to a drawing.**

*Definition:* Process should include the following:

- apply general dimensioning notes
- apply general assembly notes
- apply general shop notes
- apply special material notes

Process/Skill Questions

**G007: Develop patterns, including radial and parallel line patterns.**

*Definition:* Process should include the following:

- understand properties of cones and pyramids
- understand properties of prisms and cylinders
- use pattern development to indicate fold or bend lines in flat drawings of sheet metal products (e.g., HVAC ducts, filing cabinets).

Process/Skill Questions

**G008: Select the appropriate types of projections to represent objects.**

*Definition:* Process should include the following:

- select orthographic, which show multiple views of object
  - select auxiliary, which show the true shape of object
  - select sectional, which show interior features of object
- (Selection should indicate type of projection which best communicates design of object)

Process/Skill Questions

**G009: Apply mechanical symbols to a drawing.**

*Definition:* Process should include the following:

- apply machine processing symbols (e.g., diameter, radius, counterbore, countersink, depth, finish)
- apply welding symbols (e.g., fillet, spot, plug)

Process/Skill Questions

**G010: Prepare detail and assembly working drawings.**

*Definition:* Process should include the following:

- prepare detail drawings
- design layout assemblies
- design working assemblies
- design pictorial assemblies (oblique pictorial and exploded and assembled isometric pictorial)
- design outline assemblies
- design 3-D modeling
- prepare parts list and bill of materials.

Process/Skill Questions

**DUTY H:****Performing Architectural Drafting and Design Operations with extensive use of CADD****Task:****H001: Describe key developments in the history of architecture.**

*Definition:* Process should include the following:

- discuss influential styles, notable architects, and historical periods, including Roman, Gothic, and Colonial

Process/Skill Questions

**H002: Identify the basic principles behind codes.**

*Definition:* Process should include the following:

- identify underlying reasons for codes to include safety, consumer protection, legal requirements (e.g., ADA provisions), standardization of fixtures (e.g., electrical, plumbing, HVAC, cabinets), and fire prevention

Process/Skill Questions

**H003: Apply architectural symbols to a drawing.**

*Definition:* Process should include the following:

- apply architectural symbols that represent construction elements to include electrical elements, plumbing elements, appliances, doors, windows, HVAC, and materials

Process/Skill Questions

**H004: Identify items that comprise a set of working drawings.**

*Definition:* Process should include the following:

- include in working drawings, elements such as cover sheet, presentation drawing, site plans, floor plans, foundation plans, elevations, electrical plans, plumbing plans, HVAC plans, wall sections, fireplace details, stair details, cabinet details, framing plans, roofing plans, and schedules.

Process/Skill Questions

**H005: Design a site plan.**

*Definition:* Process should include the following:

- develop a site plan including freehand sketches influenced by a site survey, site contour, structure locations, setback requirements, benchmark locations, and adjacent property and zoning restrictions

Process/Skill Questions

**H006: Prepare a site plan.**

*Definition:* Process should include the following:

- locate benchmark
- draw property lines
- draw contour lines
- draw structure(s)
- add symbols and dimensions
- add landscaping
- add elevation callouts, such as corners of structures, corners of lots, and centers of streets

Process/Skill Questions

**H007: Design a floor plan.**

*Definition:* Process should include the following:

- create freehand sketches illustrating walls, windows, and doors giving consideration to consumer needs, such as budget, family size, and lifestyle, foot-traffic patterns, kitchen functionality requirements, geography of the site, building code guidelines for room sizes, and other building code requirements

Process/Skill Questions

**H008: Prepare a floor plan.**

*Definition:* Process should include the following:

- draw walls, doors, windows, fixtures, appliances, and cabinets in proper locations
- dimension floor plan
- apply necessary symbols
- locate stairs if necessary
- add room names

Process/Skill Questions

**H009: Design a foundation/basement plan.**

*Definition:* Process should include the following:

- make design decisions regarding pier or post locations, wall locations, chimney locations, if applicable, stairs locations, if applicable, wall makeup and levels of thickness, room sizes for basement, if applicable, window and door locations for basement, if applicable, and vent and access door locations for crawl space, if applicable

Process/Skill Questions

**H010: Prepare a foundation/basement plan.**

*Definition:* Process should include the following:

- draw piers, posts, walls, and chimney foundations, if applicable
- draw footings for piers, posts, walls, and chimneys
- locate and drawing supporting beams
- indicate size, direction, and spacing of floor joists or trusses
- locate vents, access door, windows, and doors
- locate stairs, if applicable
- dimension the plan
- apply any necessary symbols
- add basement room names, if applicable

Process/Skill Questions

**H011: Design a wall section plan.**

*Definition:* Process should include the following:

- make decisions regarding building code guidelines considering footing and wall size for foundation wall, ceiling height for crawl space or basement, floor framing design, type of sub flooring and finished flooring, wall framing design, interior wall and ceiling materials, wall, floor, and roof insulation, roofing system design, including rafter and ceiling joist construction, truss design, and slopes and pitches, roofing materials, including types of sheeting and shingles, cornice and guttering design, and exterior siding materials

Process/Skill Questions

**H012: Prepare a wall section plan.**

*Definition:* Process should include the following:

- Set scale and include sectional drawings
  - footings and foundation walls
  - floor framing design with sub flooring
  - stud walls, interior wall covering, exterior wall materials, ceiling materials finished floor, and necessary moldings
  - roof framing system
  - cornice with gutters
- dimension and label all elements of wall section, add grade lines, and all necessary symbols

Process/Skill Questions

**H013: Design an electrical plan.**

*Definition:* Process should include the following:

- develop freehand sketches reflecting consultation of architectural product catalogs (e.g., Sweets, Thomas Register)
- consult floor plan and national electrical code and calculate
  - number of general lighting circuits and required wattage
  - number of special appliance circuits and required wattage
  - number of individual appliance circuits and required wattage
  - total wattage and amperage requirements
- choose distribution panel based on amperage requirements, lights, types of switches, and switch locations, outlet locations, and location for distribution panel and meter base

Process/Skill Questions

**H014: Prepare an electrical plan.**

*Definition:* Preparation, using an outline of the floor plan as a guide, should include the following:

- set scale
- locate outlets
- locate lights and switches
- indicate which outlets and lights the switches control (by drawing connecting lines)
- locate distribution panel and meter base and indicate voltage and amperage rating
- draw a symbol schedule, if required
- draw a lighting schedule, if required
- add a circuit data chart
- apply any necessary symbols
- dimension plan, as necessary.

Process/Skill Questions

### **H015: Design a plumbing plan.**

*Definition:* Process should include the following:

- develop freehand sketches reflecting consultation of architectural product catalogs (e.g., Sweets, Thomas Register).
- follow plumbing codes, considering consumer needs, i.e., budget, family size, and lifestyle
- make decisions regarding types of fixtures and their location, to include
  - sinks
  - tubs, showers, and hot tubs
  - water closets (commodes)
- design water supply system, to include
  - supply source (e.g., private well, town water)
  - types of supply pipe, valves, tanks
  - water heater
  - water treatment devices
- design water and waste removal system, to include
  - removal method (e.g., septic system, sewer system)
  - types of water/waste removal pipe, valves, septic tank (if applicable).

Process/Skill Questions

### **H016: Prepare a plumbing plan.**

*Definition:* Process should include the following:

- use floor plan to begin setting scale to include the following:
  - draw symbols for all plumbing fixtures
  - locate and draw drain and soil vent stacks
  - draw the connection of all fixtures and floor drains to the house drain
  - locate and draw the building main for the water supply system
  - draw hot and cold water mains and branch lines
  - identify each element of the plumbing system and showing sizes
  - add a plumbing fixture schedule, a symbol legend, and general notes as required

Process/Skill Questions

**H017: Design a window and door schedule.**

*Definition:* Process should include the following:

- develop freehand sketches reflecting consultation of architectural product catalogs (e.g., Sweets, Thomas Register).
- follow guidelines set in building and fire codes
  - consumer needs
  - room sizes
  - window and door location and sizes
  - architectural style.

Process/Skill Questions

**H018: Prepare a window and door schedule.**

*Definition:* Process should include the following:

- consult architectural product catalogs (e.g., Sweets, Thomas Register) placing symbols on floor plan.
- include symbols, quantities, types, rough openings, nominal sizes, manufacturer names, manufacturer part or stock numbers, and general description on window and door schedule

Process/Skill Questions

**H019: Design kitchen cabinets and bath vanities.**

*Definition:* Process should include the following:

- develop freehand sketches reflecting consultation of architectural product catalogs (e.g., Sweets, Thomas Register).
- consult building and fire codes incorporating consumer needs, kitchen and bath room sizes, and architectural style

Process/Skill Questions

**H020: Prepare kitchen cabinet and bath vanity details.**

*Definition:* Process should include the following after setting scale of drawings:

- draw detailed elevation for each cabinet face in the kitchen
- draw a detailed elevation for each cabinet face in the bath
- draw portions of floor plan that show location of cabinets
- add symbols to indicate cabinet sizes and identifications
- add cabinet schedule, if necessary.

Process/Skill Questions

**H021: Design a set of stairs.**

*Definition:* Process should include the following:

- develop freehand sketches that reflects consumer needs and designer's choice(s) for type(s) of stairs such as
  - straight run
  - L stairs
  - double L stairs
  - U stairs
  - winder stairs
  - spiral stairs
- select materials for treads, stringers, risers, railings, balusters, and newel posts
- calculate
  - total stair rise, based on material used in home
  - stair unit rise, based on standard rise/run formulas, desired slope, and building codes
  - stair unit run, based on standard rise/run formulas, desired slope, and building codes
  - total run
  - total headroom
  - stairwell opening

Process/Skill Questions

**H022: Prepare a detail drawing of a set of stairs.**

*Definition:* Process should include the following after setting the scale of drawings:

- lay out the total rise, total run, and stairwell opening as an elevation
- lay out unit rise and unit run on stringers in the elevation
- draw treads and risers
- draw rails, balusters, and newel posts
- draw plan view of stairs
- apply all necessary symbols to stair detail
- dimension stairs

Process/Skill Questions



**H023: Design a fireplace.**

*Definition:* Process should include the following:

- develop freehand sketches that reflect building codes, consumer needs and designer's choice of materials, type of hearth (raised or floor-level), and type of fireplace
  - free-standing
  - wall-hung
  - single-face
  - two-face (adjacent and opposite)
  - three-face
- determine opening size, height, and depth of fireplace and calculate size of damper and flue

Process/Skill Questions

**H024: Prepare a detail drawing of a fireplace.**

*Definition:* Process should include the following after setting scale of drawing:

- draw front view of fireplace
- draw plan view of fireplace in full section
- draw right-side view of fireplace in full section
- draw in partial material symbols on fireplace
- dimension fireplace
- apply all material symbols.

Process/Skill Questions

**H025: Design elevations.**

*Definition:* Process should include the following:

- use knowledge of various types of home designs to draw freehand sketches of each side of house, taking into account grade of land and desired roof design.
- consider needs and tastes of consumer
- use wall sections, floor plan, window and door schedule, and foundation plan to determine
  - grade line of land
  - type of outside siding
  - roofing material
  - heights of finished floor and ceiling
  - roof slope
  - window and door appearance

Process/Skill Questions

**H026: Prepare elevations.**

*Definition:* Process should include the following after setting scale of drawing:

- use floor plan to project horizontal length of exterior walls, windows, doors, and other elements
- use wall section to project heights of the grade line, depth and thickness of footings, window and door heights, eaves line, and roof height
- darken in all object lines
- add details such as railing, window muntins, trim, window wells, and gable ventilators
- add dimensions, notes, and symbols
- identify each elevation as front, right, left, or rear immediately below drawing
- identify grade lines and finished floor and ceiling levels
- identify roof features, such as slope, and chimney height and size

Process/Skill Questions

**H027: Dimension architectural drawings.**

*Definition:* Process should include the following:

- use aligned dimensioning system
- use feet and inches to indicate location and size of frame and masonry walls, as well as doors and windows
- include indications of standard sizes of materials used and identification of the drawing's scale

Process/Skill Questions

**H028: Estimate material quantities.**

*Definition:* Process should include the following:

- estimate square yards of concrete for footings
- estimate number of concrete masonry units (CMUs) or square yards of concrete for masonry foundation wall
- estimate quantities of various sizes of lumber for floor framing, wall framing, and roof framing
- estimate quantities of wall and floor coverings and moldings
- estimate quantities of roofing and siding materials
- estimate quantities of plumbing and electrical fixtures and materials
- estimate quantities of decking and porch materials, if applicable.

Process/Skill Questions

**H029: Prepare a rendered presentation drawing.**

*Definition:* Process should include the following:

- develop freehand sketch reflecting consumer needs
- develop presentation drawings in one-point, two-point, or three-point perspective
- consider presentation media, drawing materials, line techniques, and shading

Process/Skill Questions

**H030: Build a presentation model.**

*Definition:* Process should include the following:

- determine amount of detail required and set scale
  - determine materials
  - form board or cardboard
  - glue
  - straight pins
  - paint
  - basswood or balsa wood
  - landscaping items (e.g., trees, bushes)
- construct model
  - floor plan base
  - wall construction
  - interior walls
  - windows and doors
  - wall attachment
  - wall finishing
  - cabinetry and fixtures
  - roof construction
  - outdoor areas
  - landscape features

Process/Skill Questions

**H031: Prepare a cover sheet.**

*Definition:* Process should include the following after setting scale for drawing on cover sheet:

- create one-point, two-point, or three-point perspective to present drawing
- consider additional choices
  - light source
  - type of landscape
  - shading technique, i.e., pencil and charcoal (black and white) or colored pencil

Process/Skill Questions

**DUTY I:**  
**Preparing a Career Portfolio**

**Task:**

**I001: Plan a portfolio.**

*Definition:* Process should include the following:

- determine most favorable options for displaying drafting work in a professional manner
- include work that demonstrates drafter's versatility
- utilize variety of media and display materials
  - three-ring binder
  - bound volume
  - diary or journal
  - manila folder
  - 18 x 12 flat portfolio
  - slideshow presentation software
  - web pages
- discuss role of portfolio in hiring process

Process/Skill Questions

**I002: Gather material for a portfolio.**

*Definition:* Process should include the following:

- gather products (e.g., drawings, pictures of models) representing a variety of projects that demonstrate range of drafter's talent
  - resume
  - cover letter
  - references
  - letters of recommendation.

Process/Skill Questions

**I003: Organize a portfolio.**

*Definition:* Process should include the following:

- create portfolio organized into sections (including index) labeled by subject areas
  - architectural drawings
  - mechanical drawings
  - manual drawings
  - projects
  - awards and recognition (SkillsUSA–VICA, academic, and others)
  - general (resume, cover letter, letters of recommendation)

Process/Skill Questions

**I004: Present a portfolio.***Definition:*

- use presentation methods, including slide show, web page, and manual browsing of portfolio contents.
- appear professional and possess strong oral communication skills

*Process/Skill Questions*

# **Technical And Professional Curriculum Frameworks**

## **Purpose**

This section of the framework contains material to help instructors in technical and professional programs to reinforce basic skills in the areas of Reading and Writing, Math and Science. The technical portion of this guide takes a more direct approach by using specific duty and task listings, but changes in the academic section lead in a more general direction. The reason for this is simple: all good instructors do not teach in the same way. However, all good instructors share the trait of being able to connect their material to everyday life. For example, understanding concepts related to heat, are important for cosmetology students as well as lathe operators in manufacturing plants. However, each program will probably take a different approach in the amount of detail and examples relating to heat concepts. Both groups require basic science knowledge of principles relating to heat, but the application of the principles will be different.

## **Basic Skills: The Content Areas**

Included in this guide are materials to support basic skills in Reading and Writing, Mathematics, and Science. The overall approach taken here is a move toward problem-solving skills. By problem-solving, we mean the ability to take information and use it for a purpose: to take action, make decisions, predict outcomes, suggest improvements. Another term for these thinking skills is a general “literacy.”

Literacy skills have always been in demand in the workplace. A quick review of workplace training programs and other literature regarding adult education demonstrates that the need for a literate workforce is still one of the most pressing problems employers face today. Indeed, many employers (from small- and medium-sized businesses to Fortune 500 companies) have spent hundreds of millions of dollars on in-house basic skills training programs.

What constitutes a literate workforce? There are many definitions for literacy and hundreds of tests that measure it, but when employers are asked what they're looking for in potential new hires, the answers are general: they want individuals who can read and write; show up on time; think and solve problems, and keep their personal lives in order (that is, don't bring a drinking problem into the workplace).

Viewed in this way, the words "literacy" and "literate" are good terms for what educators are trying to instill in their students, the future workforce. The more common definition (being able to read and write) is certainly appropriate but the additional definitions (knowledgeable, educated, well-informed) are also apt. It is this broad term, "literate," that we use to guide instructors on what to cover in the classroom. No matter which vocational-technical area is being focused on, no matter how technical the terminology is, instructors are given the task of helping students take information, break it down into necessary parts, process details, and be able to come away with an understanding of some sort. This is "literacy", and the process is the same for every subject area-- teaching students how to think and solve problems.

## **Format**

Each section includes a two-column table. Skills are listed on the left side; suggestions for implementing these skills into the curriculum are listed on the right side. Each suggestion is written in such a way that it can be tailored to most vocational-technical programs.

## **Using The Guide**

This guide was prepared with four concepts in mind:

- The instructor is *aware of the need* for students to improve their basic skills.
- The instructor is the *best-qualified person* to decide how to include this material in the classroom or lab. The students' abilities and needs should drive the instructor in deciding how to use, expand, or modify these topics.
- The instructor *already has curriculum that works* for his or her students. Therefore, the suggestions for reinforcing basic skills
  - must be easy to implement
  - must stand alone

- do not need to be taught in a particular order
  - must be open-ended enough to be useful for any technical/vocational program.
- ***Time is limited.*** Unless there are quick ways to reinforce basic skills, changes to the curriculum will not be made. Teaching basic skills in the context of technical material will help students make connections that are more memorable, and will require no additional lesson planning. Just as instructors incorporate updates in technical knowledge, they can add basic skills concepts as well. Adding a few concepts at a time will help students perform better in the lab as well as on tests and evaluations.

## Methods

The following methods may help instructors decide how to increase basic skill knowledge:

- *Collaborative projects*- how could a joint project between regular education teachers and vocational instructors reinforce concepts for both programs?
- *Outside assignments*- would students benefit from an outside assignment explaining how a basic math (science, reading) concept ties to a process in the lab?
- *Extra credit*- students needing extra credit can research outside topics and turn in a short summary of material
- *“Need-to-know” assignments*- Students prepare a bulleted list of the basic concepts in science they need to know in order to correctly perform \_\_\_\_ operation in the lab.
- *Question of the Day*- a few daily math problems for students to answer at the beginning of class allows the instructor to set the tone for the material. It also gives students an immediate goal when they enter the classroom and teaches them to stay on task. Bonus points may be awarded at the end of the week, quarter, semester, etc.
- *Two-minute Oral Presentations*- students who need to practice speaking skills can be asked to give a two-minute oral presentation at the end of class summarizing the main points for the day. Or, a two-minute presentation at the beginning of class can recap the material from a previous class.
- *Connecting with Workers*- students can poll parents, friends, area employers or other persons to find out the top 5 basic science skills needed on the job.



- *Direct Questioning*- include a few basic knowledge questions in a presentation. Award points to groups based on correct answers.

## Resources

In creating the Academic Reinforcement material for the technical and professional frameworks, we used a number of source documents and resources.

- The English Language Arts, Science, and Mathematics components of the *Curriculum Improvement Project* by Dr. Willard Daggett were consulted to ensure that the top-ranked skills in those areas would be reflected in the academic support material. The English Language Arts and Science components have many linkages to the material included here. (The higher-level math skills such as trigonometry were not included in this document.)
- Data from work with Arkansas employers- the Workplace Skills Enhancement Program (WSEP) at the University of Arkansas at Little Rock (UALR) has completed many training projects and job profiles for employers in Arkansas. Our constant contact with workers and employers provides a tremendous amount of data that we use in designing customized training programs and in working on projects such as curriculum frameworks. Also, the staff of WSEP has experience teaching in Arkansas public schools, the US military, and the Job Corps.
- Additionally, other groups within UALR (the Labor Education Program, the Institute for Economic Advancement and the College of Business) provide resources regarding health and safety information, labor unions and their role in the workplace, computer and information technology and other training and outreach program data.
- US Department of Labor- the US DOL has many online documents and publications that support workers and issues regarding the workplace. (Work by Philippi and Greenan, 1988 on workplace skills was especially helpful.) Visit the website at [www.dol.gov](http://www.dol.gov).
- Occupational Safety and Health Administration (OSHA) provides online and other resources for instructors and professionals. For topics relating to safety and health, visit [www.osha.gov](http://www.osha.gov).

- Multistate Academic and Vocational Curriculum Consortium (MAVCC) is an organization that develops competency-based curriculum. For more on MAVCC see [www.mavcc.org](http://www.mavcc.org).

# ACADEMIC STANDARDS FOR READING AND WRITING

## Strategies for Reinforcement in the Vocational-Technical Classroom

**Note:**

\* indicates industry-related materials, handouts, notes, etc.

Objective	Classroom Applications to Industry
<p><i>Present, Review and Discuss, Master</i> <b>the list of skills employers want for the workplace regarding reading and writing.</b></p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> <li>• Discussion</li> <li>• Interviewing parents or other adults in the workplace about the skills required</li> <li>• Interviewing employers about the skills in terms of importance</li> <li>• Identifying workplace situations in which certain skills become more important than others</li> <li>• Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs</li> <li>• Researching the topic of adult literacy</li> </ul>
<p><i>Answer</i> <b>simple comprehension or recall questions from a lecture or from written material.</b></p>	<p>Provide 2 examples of workplace materials* on students' reading level.</p> <p>With the first, allow students to read information and then answer brief recall questions.</p> <p>With the second example, read aloud the material but do not give a handout. Ask brief recall questions.</p> <p>Compare the differences...how do students retain information better—orally or visually? Discuss learning styles and impact on the job.</p>
<p><i>Follow, Give</i> <b>oral instructions.</b></p>	<p>Using instructions for a hands-on task, have students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.</p>

<i>Follow,</i> <b>Give written instructions.</b>	Using a short list of instructions for a hands-on task, have students give <u>written</u> instructions to a partner or group. Rate the effectiveness of the speaker.
<b>Show the difference between relevant and irrelevant details.</b>	Using a copy of workplace materials*, students underline relevant or important details in red, irrelevant or less important details in blue.
<b>Sort objects based on x number of criteria.</b>	Using workplace materials*, sort a group of objects based on characteristics identified by instructor (e.g., by color, shape, defect, or a combination of these).
<i>Recognize,</i> <b>Identify technical vocabulary.</b>	Using workplace materials*, highlight technical vocabulary terms.  Create a class dictionary of industry-related technical vocabulary. Students may add illustrations or diagrams. Each student receives a copy of the final product. Emphasize skills such as alphabetical order, guidewords, prefixes, suffixes, and pronunciation guides.
<b>Read aloud.</b>	Read aloud from workplace materials* in groups or individually.
<b>Identify,</b> <b>Explain symbols, abbreviations and acronyms relevant to subject area.</b>	Using workplace materials*, highlight symbols, abbreviations, and acronyms.  Create a table with one column for each of symbols, abbreviations, acronyms. Classify each one and write in the meaning.
<b>Understand,</b> <b>Use rules of grammar, usage, spelling, punctuation.</b>	Identify the missing punctuation mark, misspelled word, incorrect use of grammar from workplace materials*.  Correct the mistakes.
<b>Discuss <u>uses and purposes</u> of a variety of workplace communication tools.</b>	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and diagram.
<b>Duplicate process demo by instructor</b>	Using a workplace process, demonstrate steps

	to complete and have students perform individually or in groups.
<i>Notice,</i> <b>Apply word analysis techniques.</b>	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g. therma = heat) <sup>1</sup>
<b>Match parts from photographs or diagrams to actual objects.</b>	Using workplace materials*, follow a sequence of pictures or diagrams to build, create, or copy an item or process.
<b>Read for main ideas and for details.</b>	Use a graphic organizer <sup>1</sup> to show main ideas and supporting details.
<b>Distinguish between fact, opinion, and inference.</b>	Collect examples of materials based on fact or opinion/inference. Ask students to underline key terms that indicate the presence of facts or opinions.
<b>Distinguish between rows and columns; identify a cell as a block where a row and column intersect.</b>	Using charts or tables from workplace materials*, discuss the reasons for this format.  Identify the quantity in a particular cell.
<i>Select,</i> <b>Use appropriate resources and reference tools.</b>	Explain the uses for the following: Dictionary, Thesaurus, Almanac, Atlas, Card Catalog, Encyclopedia.  List reasons for choosing one reference tool over another.  Use reference tools to answer questions related to industry or current events.
<b>Paraphrase written or oral material into summary form.</b>	Using workplace materials*, determine the best way to condense or shorten the material so as to give an overview to a layperson.  Using a set of guidelines appropriate to students' level in length and detail, summarize the information into bullet points.

<p><i>Interpret,</i> <i>Fill out/complete</i> <b>forms and records.</b></p>	<p>Using workplace materials*, answer basic questions (e.g., summarize the list of parts from an inventory).</p> <p>Using blank forms or documents, fill in details. Pay close attention to directions. Students critique work with partner.</p> <p>Create a form or document to be used in a workplace process.</p>
<p><i>Use,</i> <i>Develop</i> <b>a process for remembering details.</b></p>	<p>Use pneumatic devices to organize and remember details. Pneumatic devices<sup>1</sup> include Semantic Maps, Thought Webs, and other creative tools to organize thinking.</p>
<p><i>Proofread,</i> <i>Correct</i> <b>mistakes in written drafts.</b></p>	<p>Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage.</p> <p>Correct mistakes in written drafts.</p>
<p><i>Examine</i> <b>different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc).</b></p>	<p>Gather samples of workplace materials*. Identify each by type.</p> <p>Compare and contrast the difference between audience, (who the document is written for) length, background information/education needed to understand material, level of detail, organization and layout of the document.</p>
<p><i>Understand</i> <b>the writing process.</b></p>	<p>In order to apply the writing process, create a workplace communication tool to be used for a specific purpose.</p> <p>Prewrite: Brainstorm, gather facts, or do research to create a <u>business letter, memo, report, brochure, proposal, schematic, map, or diagram.</u></p> <p>Identify the audience.</p>

	<p>Determine the purpose of the document.</p> <p>Write: Create a first draft.</p> <p>Revise and Edit: Make changes to ensure accuracy.</p> <p>Look at the writing from a different point of view.</p> <p>Shorten or make more concise where possible.</p> <p>Use white space, bold print and other formatting details to make the document easy-to-read.</p> <p>Publish: Decide on the best format for the final copy (size, type of material, layout, graphics, etc.)</p> <p>Publish the final draft.</p>
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<p><i>Identify,</i> Create <b>sentences of different types.</b></p>	<p>Using workplace materials*, find sentences of varying types. Examples include Simple Sentences (subject + predicate) Complex Sentences (subject + predicate including clauses).</p> <p>Write sentences, paragraphs, or essays using sentences of different types (e.g., write a 2-paragraph summary of today's lesson).</p>
<p><i>Identify,</i> Use <b>contractions correctly.</b></p>	<p>Using workplace materials*, locate contractions (e.g., isn't, I'll).</p> <p>Identify misuses of contractions.</p> <p>Write a short list of directions relating to an industry process and use as many contractions as possible.</p>
<p><i>Identify,</i> Use <b>correctly commonly misspelled words.</b></p>	<p>Using a list of commonly misspelled words<sup>1</sup>, locate errors in the media (newspaper articles, Internet sites, magazines.)</p> <p>Ask each student to identify his problem words from the list.</p> <p>Attempt to incorporate problem words into class activities (e.g., add them to a list of work instructions).</p> <p>Give short weekly quizzes focusing on 5 words per week. Award bonus points.</p>
<p><i>Identify,</i> Use <b>correctly the English irregular verbs.</b></p>	<p>From a list of irregular verbs, review the uses of each.</p> <p>Ask each student to identify his problem irregular verbs from the list.</p> <p>Attempt to incorporate problem verbs into class activities, such as making a collection of mistakes from print.</p>
<p><i>Identify,</i> Use <b>Signal Words and other cues to improve writing.</b></p>	<p>Use a list of Signal Words<sup>1</sup> and discuss their purpose in writing (signal words are words that raise a flag to a reader to pay attention.)</p>



	<p>Examples: Signal Words showing emphasis: Most of all, It should be noted, Of course</p> <p>Signal Words showing a conclusion: Lastly, In summary, Finally</p> <p>Identify common signal words in workplace writing, especially in sequenced lists.</p> <p>Write a list of work instructions using signal words.</p>
<b>Identify components of workplace documents such as blueprints, schematics, floor plans, and other industry-related documents.</b>	Label the parts of a workplace document.
<b>Place steps in proper sequence.</b>	Using a list of steps or pictures cut them apart so that students can place them in the proper order.
<b>Analyze cause and effect.</b>	Experiment with cause and effect in the classroom (e.g., change the sequence of events in a process).
<b>Determine missing information.</b>	<p>Locate the information that is missing from a problem and explain why the problem cannot be solved without it.</p> <p>To reinforce concepts, use a completed problem and remove the important details. Ask students if they can identify what's missing.</p>
<b>Differentiate between tools used for a job.</b>	Given a list of tools and a list of functions, identify the most efficient tool for each task.
<b>Assemble or disassemble objects.</b>	<p>From a list of oral or written instructions, assemble an object or complete a process.</p> <p>Students write the instructions for disassembly.</p>
<b>Cross-reference materials to compare information.</b>	Using more than one source document, compare the information given.

<i>Interpret reasoning behind rules or regulations.</i>	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
<i>Show contrasts between approaches.</i>	<p>Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.)</p> <p>Compare and contrast each approach from the perspective of a worker, manager, supervisor.</p>
<i>Organize data in a new format.</i>	Using workplace materials*, organize the information into a new format.
<i>Prove a rule or method's sufficiency.</i>	Perform an experiment to determine how much tolerance is acceptable in a case study, (e.g., find the range of drops of red dye sufficient to match the standard red color used in latex paint).
<i>Show relationships between two or more systems.</i>	Using 2 or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
<i>Given examples of emergency situations, identify real world course of action.</i>	Using an emergency situation common to your industry, outline a step-by-step plan for action.
<i>Identify variables that affect the outcome of a process.</i>	Experiment with or predict variables that affect the outcomes for a process (e.g., weather patterns that adversely affect a process, such as building a road).
<i>Infer situations that meet guidelines when complete information is not available.</i>	<p>Given a policy or industry standard that has debatable interpretations, list possible situations that can arise that do not have clear solutions in the policy.</p> <p>Discuss or debate the issues.</p>
<i>Compare finished products to a set of guidelines.</i>	Compare a set of objects to a set of guidelines (e.g., analyze a batch of parts and document how they do or do not meet a set of Quality Assurance guidelines).

	List any discrepancies (parts that do not meet guidelines) and categorize them by type (e.g., burns, holes, etc).
<b><i>Identify preventative measures for maintenance of a system.</i></b>	List the needed routine maintenance to keep a system working properly.
<b><i>Predict new standards or rules that may become necessary in the future.</i></b>	Identify recent areas of change or development in your industry.  Discuss potential future needs or developments that may occur (e.g., potential need for better training requirements for airport personnel).
<b><i>Improve a process by streamlining (locating waste) or decreasing lost time.</i></b>	Examine a process in industry in step-by-step detail. Suggest ways to decrease time needed or make the process more efficient.  Isolate the cause of failure in a process by performing an experiment.
<b><i>Prepare a model explaining a concept.</i></b>	Build, draw, or create a model that explains a concept (e.g., show a need for environmental standards for water or air pollution).

<sup>1</sup> Fry, Edward; Kress, Jacqueline; Fountoukidis, Dona. *Reading Teacher's Book of Lists*, 4<sup>th</sup> ed. ISBN 0-13-028185-9.

# ACADEMIC STANDARDS FOR MATHEMATICS

## Strategies for Reinforcement in the Vocational-Technical Classroom

**Note:**

\* indicates industry-related materials, handouts, notes, etc.

**Topics Listing**

Problem Solving

Operations and Calculations

Applications

Data Analysis and Display

Objectives	Classroom Applications to Industry
<p><i>Present</i>  <i>Review and Discuss</i>  <b>Master the list of skills employers want for the workplace regarding mathematics.</b></p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> <li>• Discussion</li> <li>• Interviewing parents or other adults in the workplace about the skills required</li> <li>• Interviewing employers about the skills in terms of importance</li> <li>• Identifying workplace situations in which certain skills become more important than others</li> <li>• Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs</li> <li>• Researching the topic of adult literacy</li> </ul>
PROBLEM SOLVING	
<p><i>Examine</i>  <b>Apply problem-solving process.</b></p>	<p>Define the problem  What is being asked?  Decide on a type of solution  Multi-step or single-step question?  Try any of these:  Estimate an answer  Draw a diagram  Find a pattern</p>

	<p>           Guess and check            Logical Reasoning            Make a graph            Make an organized list            Make a table            Solve a simpler problem            Use a simulation            Work backwards            Write an equation         </p> <p>           Locate information you need            Do you have all the components?         </p> <p>           Get missing information            May need to perform some other calculations         </p> <p>           Calculate                Look at the answer.                How should the remainder be expressed?         </p> <p>           Check the solution                Is it reasonable?         </p>
<b>OPERATIONS AND CALCULATIONS</b>	
<i>Read, write, and count numbers.</i>	<p>Read and write numbers (especially focus on very large and very small numbers where mistakes are common).</p> <p>Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ____ 0.4455    &gt; or &lt;</p> <p>Put these in order from smallest to largest: 0.66, 0.677, 0.67</p>
<i>Round numbers.</i>	<p>Discuss your industry's use of decimals.</p> <p>Identify the place values needed to adequately perform a job. For example, a Quality Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.</p>

	Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.
<i>Estimate numbers.</i>	<p>The skill of making close estimations is tied to understanding accuracy.</p> <p>Discuss real-life situations where estimation is used.</p> <p>Discuss the practice of estimation before calculation. Regular practice in estimating before calculating will teach students where they make errors and will increase their estimation skills.</p> <p>Discuss work situations where estimation skills are required, and possible consequences of making estimation errors (for example, is an estimate appropriate for inventory purposes? For ordering supplies?)</p>
<i>Compute averages.</i>	<p>Discuss averages in general terms. Calculate the average temperature, average rainfall or precipitation, average number of students per class, and other relevant examples.</p> <p>Using workplace materials*, calculate a series of averages.</p> <p>For example:</p> <ul style="list-style-type: none"> <li>• Take 10 different measurements of a piece of pipe using a micrometer.</li> <li>• Compare the measurements.</li> <li>• Find the average of all the measurements.</li> <li>• Compare the average to the smallest and largest measurement.</li> <li>• Discuss the effects on quality...when is an average an acceptable benchmark measurement?</li> </ul>
<i>Calculate with whole numbers: perform one-step problems with basic operations.</i>	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of addition, subtraction, multiplication, and division.
<i>Perform problems that require an</i>	Using workplace materials*, make a list of

<p><b>understanding of the order of operations.</b></p>	<p>situations or problems that need more than one step to perform them.</p> <p>If the procedures (add, subtract, multiply, divide, etc) are on the same level of importance, such as adding or subtracting, then the order of operations will not impact the way the problem is solved.</p> <p>If a problem requires more than one level of operation to solve (example, dividing and adding), work the problem correctly by performing the division part first and then the addition.</p> <p>Rework the problem using addition first. Compare the answers.</p> <p>Discuss the importance of reasoning skills to verify that an answer makes sense.</p>
<p><i>Understand the relationship between decimals, fractions and percents.</i></p>	<p>Make a table comparing fractions, decimals, and percents.</p>
<p><i>Compute with fractions, decimals, and percents, and show understanding of the relationship between them.</i></p>	<p>Create sample problems using fractions that relate to everyday situations.</p> <ul style="list-style-type: none"> <li>▪ Poll the class on interesting topics (favorite food). Convert whole numbers to fractions. Votes- Pizza- 10 Salad- 2 BBQ- 8</li> </ul> <p><math>10+2+8 = 20</math> (recognize denominator value)</p> <p><math>\frac{10}{20}</math> Pizza <math>\frac{2}{20}</math> Salad <math>\frac{8}{20}</math> BBQ</p> <ul style="list-style-type: none"> <li>▪ Add the fractions.</li> </ul> <p><math>\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}</math></p> <ul style="list-style-type: none"> <li>▪ Convert fraction to whole number. (Total answers equal 1 class's worth of answers.)</li> </ul>

	$\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ <ul style="list-style-type: none"> <li>Convert fractions to percents.</li> </ul> $\frac{10}{20} \text{ means } 10 \text{ divided by } 20 = 0.50$ <p>Move decimal 2 places right.  <math>0.50 = 50\%</math></p> $\frac{2}{20} \text{ means } 2 \text{ divided by } 20 = 0.10$ <p><math>0.10 = 10\%</math></p> $\frac{8}{20} \text{ means } 8 \text{ divided by } 20 = 0.40$ <p><math>0.40 = 40\%</math></p> <p><math>50\% + 10\% + 40\% = 100\%</math>      Notice the totals add to 100%.</p> <p>So, <math>\frac{20}{20} = 1 = 100\%</math></p> <p>Using workplace materials*, calculate work-related questions using fractions, decimals, and percents.</p> <p>Calculate shipping costs for internet purchases (such as music from amazon.com).</p>
<b><i>Solve formulas and equations.</i></b>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of equations.</p> <ul style="list-style-type: none"> <li>Work left to right</li> <li>Use order of operations</li> <li>Place numbers on one side, variables on the other side</li> </ul>
<b><i>Obtain squares and square roots.</i></b>	<p>Review the methods for calculating squares, square roots, cubes, and cube roots. Use industry-related formulas to demonstrate examples.</p> <p>Compare the difference between the 2 common answers to <math>3^2</math> (answer = 9, not 6).</p>



	How would an incorrect value affect the work on the job?
<b>Convert units of measure:</b> <i>Recognize components of measuring systems (US and metric) for length.</i>	Discuss industry measures and terms relating to length.
<b>Convert units of measure:</b> <i>Recognize components of measuring systems (US and metric) for mass/weight.</i>	Discuss industry measures and terms relating to mass/weight.
<b>Convert units of measure:</b> <i>Recognize components of measuring systems (US and metric) for volume.</i>	Discuss industry measures and terms relating to volume.
<i>Measure with a certain degree of accuracy.</i>	<p>Estimate measurements.</p> <p>Using workplace materials* and tools, take measurements of work-related and classroom items.</p> <p>Depending on ability level, students may measure to the nearest foot, inch, centimeter, etc.</p>
<b>APPLICATIONS</b>	
<i>Solve word problems.</i>	Help students feel more comfortable with word problems by placing simpler problems in word problem form; or take concepts students have already mastered and ask them to write word problems for each other to solve.
<i>Select/apply mathematical formula.</i>	Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.
<i>Understand the importance of time in the workplace.</i>	Using workplace materials*, make a list of workplace scenarios that require using time correctly, such as keeping a time card, or heating a liquid solution for 20 minutes.
<i>Recognize components of time systems (clocks and calendars).</i>	<p>AM and PM</p> <p>Leap Year</p> <p>Military time</p>

<p><i>Discuss, Identify, Understand</i> <b>terms relating to measuring time.</b></p>	<p>Discuss the units of time measurement and time vocabulary: second, minute, hour, day, week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.</p>
<p><i>Understand</i> <b>that time can be expressed in terms of equivalencies.</b></p>	<p>Show the time equivalencies using fractions. For example:  <math>1 \frac{1}{2} \text{ days} = \underline{\hspace{1cm}} \text{ hours}</math></p> $\begin{array}{rcl} 1 \text{ day} & = & 24 \text{ hours} \\ + \frac{1}{2} \text{ day} & = & +12 \text{ hours} \\ \hline 1 \frac{1}{2} \text{ days} & = & 36 \text{ hours} \end{array}$
<p><i>Compute</i> <b>time conversions.</b></p>	<p>Make a table that shows the equivalencies of time units.</p> <p>Compute conversion problems at the appropriate level of difficulty. Examples include:</p> <ul style="list-style-type: none"> <li>• Convert minutes to hours</li> <li>• Convert hours to days</li> <li>• Convert seconds to years.</li> </ul>
<p><i>Calculate</i> <b>ratio and proportion.</b></p>	<p>Review fractions when discussing ratio and proportion.</p> <p>Draw common classroom items to scale by finding a conversion rate (1 foot equals 1 inch).</p> <p>Make predictions using ratios. (If each student in class has 3 children, how many children will there be all together? Write the ratios.)</p>
<p><i>Apply</i> <b>geometry principles: Use formulas for measuring shapes of 2 dimensions.</b></p>	<p>Determine the formulas that apply to 2 dimensions: perimeter, area, surface area, etc.</p> <p>Find perimeter of classroom. Discuss perimeter of objects that are not shaped as perfect squares. How does this change the formula for perimeter?</p> <p>Find the area of the tiles on the floor. Find the area of the classroom.</p>

	Review that all areas are expressed in terms of square units (square inches, square miles, etc)
<i>Apply geometry principles: Use formulas for measuring shapes of 3 dimensions.</i>	Review the formulas that apply to 3 dimensions of objects: volume. Find the volume of common objects such as soda cans, pizza boxes, etc. Review that volume is expressed in cubic units.  Discuss industry-specific needs for these formulas; for example, find the volume of a tank or silo.
<i>Define terms relating to money.</i>	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles relating to money.  For more advanced students, include terms and principles of economics, finance, or statistics.
<i>Perform one-step problems involving money.</i>	Make change. Count up (rather than backwards) to make change.
<i>Perform multiple-step problems using money.</i>	Calculate gross and net earnings.  Calculate <ul style="list-style-type: none"> <li>▪ Interest</li> <li>▪ Sales tax</li> <li>▪ Percent off</li> <li>▪ Sale price</li> <li>▪ Profit percentages</li> </ul> Perform banking transactions.
<i>Perform business-related financial activities.</i>	At a level of complexity appropriate to your industry and to students' ability levels, solve income/expense problems, prepare budgets, etc.
<i>Use a calculator to perform computations.</i>	Identify appropriate activities that can be performed using a calculator (calculators

	<p>allow students to concentrate on problem-solving strategies.</p> <p>Award prizes for weekly activities or competitions.</p>
<i>Calculate measurements taken from measuring devices.</i>	Add, subtract, multiply and divide measurement numbers by plugging them into formulas.
<i>Perform/prepare an inventory.</i>	<p>Use a sample group of items to prepare an inventory.</p> <p>Review inventory vocabulary terms.</p> <p>Discuss the math processes that would apply to the inventory process.</p>
<b>DATA ANALYSIS AND DISPLAY</b>	
<i>Recognize types of visual representations.</i>	<p>Charts</p> <p>Graphs</p> <p>Tables</p>
<i>Interpret charts, graphs and tables.</i>	<p>Answer simple questions about charts, graphs and tables.</p> <p><i>Solve</i> multi-step problems involving the correlation of graphs and tables.</p>
<i>Collect/record data.</i>	<p>As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor website for more details.</p> <p>Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers.</p> <p>Find the range of answers (maximum and minimum). Find the average.</p> <p>Discuss an acceptable range of answers (<math>\pm</math>), and graph the results showing the number that fell inside and outside the acceptable range.</p>

<i>Review <b>and</b> apply principles of probability.</i>	Use real-life examples that are highly motivating to direct the students' attention to probability principles. (Example, "I am thinking of a number between 1 and 50. The person who guesses the number will receive that many bonus points if she can tell me the probability of choosing the number correctly.")
<b>Use probability models to predict chance events.</b>	Calculate <u>theoretical probability</u> of an event (e.g., the probability of rolling a 5 on a die is $1/6$ ).  Find <u>empirical probability</u> of an event by performing repeated experiments.  Compare the 2 probabilities.
<i>Calculate <b>and</b> interpret statistics.</i>	Identify the importance of using statistics correctly. Bring examples of statistics from the news or media and analyze them: are they ambiguous? Are they correct? What data is the advertisement trying to get the public to see?  For a humorous look at statistics, see <i>How to Lie with Statistics</i> by Huff and Geis.
<i>Interpret <b>plans/blueprints</b>.</i>	Review vocabulary and terms for plans, blueprints and schematics.  Build a plan or blueprint one layer at a time, starting with the basic identifying information.  Add layers of wax paper or other transparent drawing material on top of the first layer that allows each layer to be viewed individually, or the entire drawing as a whole.
<i>Construct <b>charts and tables</b>.</i>	Discuss chart types and chart vocabulary.  Using workplace or sample data from the class, construct tables and charts.

	<p>For a daily example, consult <i>USA Today</i> online and look for the snapshots section that shows a graph of some sort. Ask weekly bonus questions about the data.</p> <p>Challenge students to bring in examples of charts and graphs containing errors.</p>
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# ACADEMIC STANDARDS FOR SCIENCE

## Strategies for Reinforcement in the Vocational-Technical Classroom

**Note:**

**\* indicates industry-related materials, handouts, notes, etc.**

*Topics Listing*

**General Science-** topics not specific to a content area

**Physical Science-**

- Mechanics and Physics
- Energy and Waves
- Thermodynamics
- Electromagnetism
- Chemistry
- Optics

**Life Science-**

- Cell biology
- Evolution
- Genetics and Heredity
- Human and Animal Development

**Anatomy**

- Ecology
- Viruses
- Bacteria
- Plants

**Earth Science-**

- Earth in space
- Solar System/Astronomy
- Atmosphere and weather
- Oceans and water
- Earth resources

**Note:**

\* indicates industry-related materials, handouts, notes, etc.

**Objective****Classroom Applications to Industry**

<b>GENERAL SCIENCE</b>	
<p><i>Present,</i> <i>Review and Discuss,</i> <b>Master the list of skills employers want for the workplace regarding science skills.</b></p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> <li>• Discussion</li> <li>• Interviewing parents or other adults in the workplace about the skills required</li> <li>• Interviewing employers about the skills in terms of importance</li> <li>• Identifying workplace situations in which certain skills become more important than others</li> <li>• Researching adult education programs to learn why deficits in these areas must be remediated; find out the cost to employers to educate adult workers</li> <li>• Researching the topic of adult literacy</li> </ul>
<p><i>Perform</i> <b>computations as required to solve problems.</b></p>	<p>Use the metric system to convert units of measure.</p> <p>Round numbers to correct number of significant figures.</p> <p>Determine percentage of error.</p> <p>Understand validity, reliability, accuracy, and precision.</p>
<p><i>Apply</i> <b>scientific method of inquiry.</b></p>	<p>Identify the steps of the scientific method.</p> <p>Conduct experiments.</p> <p>Understand the following terminology: Conclusions vs inferences Variables Replications Samples/sample size</p>



<i>Investigate science history as it applies to industry.</i>	<p>In groups, research topics in science pertaining to your industry. Have students assign roles for each member of the group.</p> <p>Present findings in report format, or in oral presentations.</p> <p>Investigate science ethics.</p> <p>Recognize the processes available for accountability in industry. For example, OSHA has a Safety and Health Program Assessment Worksheet whereby employers can be rated for safety issues. See <a href="http://www.osha.gov/SLTC/safetyhealth_ecat/mo d3.htm">http://www.osha.gov/SLTC/safetyhealth_ecat/mo d3.htm</a></p> <p>[Note: Safety and Health is a mandatory subject of bargaining when a workplace is unionized; in both unionized and non-unionized workplaces, an employer cannot create and dominate workplace safety committees (see the National Labor Relations Act).]</p>
<i>Use scientific instruments to measure aspects of the environment.</i>	Gather data on time, length, mass, pressure, volume, acceleration or other measureables using instruments from the job.
<i>Demonstrate an understanding of data.</i>	<p>List the processes involved in gathering data.</p> <p>Suggest ways that data can be grouped or organized.</p> <p>Collect specimens.</p> <p>Show how data can be represented (graphically, charts and diagrams, etc)</p> <p>Construct a model to depict a basic concept.</p>
<i>Identify the seven basic S I (Systeme International) units.</i>	<p>Length- meter- m</p> <p>Mass- kilogram- kg</p> <p>Time- second- s</p> <p>Electric current- ampere- A</p>

	<p>Temperature- Kelvin- K Amount of substance- mole- mol Luminous intensity- candela- cd</p> <p>Dictionary of units- see <a href="http://www.ex.ac.uk/cimt/dictunit/dictunit.htm">http://www.ex.ac.uk/cimt/dictunit/dictunit.htm</a></p>
<i>Identify S I (Systeme International) Derived units.</i>	<p>Choose units appropriate to your industry (hertz, ohm, volt, watt, etc).</p> <p>Create a picture dictionary demonstrating the concepts.</p>
<i>Review relevant theories, laws and models.</i>	As relating to your industry, discuss important theories, laws and models.
<i>Use reference tools to solve problems.</i>	Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.
<i>Practice safe lab procedures.</i>	<p>Handle equipment with care.</p> <p>Demonstrate safety and first aid procedures.</p> <p>Identify harmful substances.</p>
<b>PHYSICAL SCIENCE</b>	
<i>Understand the cyclical nature of systems.</i>	<p>Show, demonstrate, model, track the cycles of any of the following systems:</p> <p>Growth and decay Food webs Weather Water</p>
<i>Analyze/classify matter according to type.</i>	<p>Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?</p>
<i>Explain the concepts of work and power.</i>	<p>Identify machines used in industry.</p> <p>Identify how energy levels change when work or power is increased/decreased.</p> <p>Identify fuel sources used in your industry.</p> <p>Discuss internal and external combustion.</p>

	Create a model demonstrating the uses of levers and pulleys.
<i>Be familiar with concepts of motion.</i>	<p>Measure acceleration and deceleration</p> <p>Understand the relationship between speed and velocity by performing experiments.</p> <p>Recognize waves and vibrations as a type of motion.</p> <p>Understand action and reaction.</p> <p>Review laws pertaining to motion.</p>
<i>Understand concepts related to force.</i>	<p>Show the need for balance of forces acting on an object.</p> <p>Observe centrifugal and centripetal forces in action.</p> <p>Show how friction is created and must be accounted for in using and preserving equipment.</p> <p>Create a chart showing types of lubricants needed in a factory and schedule of maintenance.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of inertia.</p> <p>Show the relationship between pressure, mass, and weight.</p>
<i>Understand and apply principles relating to the atom.</i>	<p>Understand that atoms have a positive, negative or neutral charge. (Classify protons, electrons, and neutrons.)</p> <p>Identify ions.</p>
<i>Investigate forms of and changes in energy.</i>	<p>Discuss how energy is measured.</p> <p>Observe changes in energy relationships.</p> <p>Identify catalysts and reactants.</p>

	Identify sources of kinetic and potential energy in your industry.
<i>Discuss, apply principles of electricity and electric currents.</i>	<p>Identify types of circuits and switches.</p> <p>Show the difference between direct and alternating currents. Give examples of the best/most efficient use of each.</p> <p>Determine how electricity is measured, and solve problems using these terms. (Example, use Ohm's law to calculate current, resistance, and voltage.)</p> <p>Identify good conductors and insulators, and how to choose them.</p> <p>Understand grounding and create a visual display of grounding safety practices. Include the threat of static electricity.</p> <p>Show the uses of a vacuum tube by building a model.</p> <p>Compare the following ways of generating electricity: Hydroelectricity Motors Solar Power Steam/nuclear Transformers Incandescent (Light) Show the implications for your industry.</p> <p>As appropriate to your industry, identify electrochemical energy sources (cells, electrodes, batteries) and the processes of oxidation and reduction.</p>
<i>Be familiar with sound waves.</i>	<p>Compare how sound waves travel between liquids, solids, and air.</p> <p>Examine different types (lengths) of sound waves. Examine decibels safe for human hearing. Identify safety precautions for industry regarding sound tolerance.</p>

	<p>Be able to use correctly the terms below as they relate to your industry. (For example, ask students to write a short essay explaining a demonstration from class and include the following terms):</p> <p>Amplification Audible range Frequency Acoustics Resonance Speed</p>
<i>Be familiar with principles of heat.</i>	<p>Differentiate between the 3 types of heat transfer (conduction, convection, radiation).</p> <p>Understand that substances expand and contract due to heating and cooling</p> <p>Identify purpose and types of insulations used.</p> <p>Differentiate between heat and temperature.</p>
<i>Investigate and apply concepts relating to temperature.</i>	<p>Use the temperature scales; convert between Celsius and Fahrenheit.</p>
<i>Explain the concepts of magnetism.</i>	<p>Understand that currents create magnetic fields.</p> <p>Identify materials that are good conductors, and the properties that make them such.</p> <p>Understand electromagnetic forces present in earth.</p>
<i>Investigate/apply chemical properties.</i>	<p>Differentiate between acids and bases. Find pH for substances used in industry.</p> <p>Identify substances used in your industry and classify them by type.</p> <p>Name the major drugs, fertilizers, or additives used in your industry. Define and state examples of chemical reactions.</p> <p>Be familiar with solutions used in your industry. Compare saturated and unsaturated solutions. Determine whether a solution is soluble or insoluble.</p>

	Explain solute and solvent.
<i>Investigate forms of and changes in matter.</i>	<p>Compare and contrast physical and chemical changes.</p> <p>Discuss the types of physical or chemical changes that take place in your industry, from processing raw materials to manufacturing.</p>
<i>Understand and apply concepts relating to the elements.</i>	<p>Examine the 4 elements that make up 99% of living organisms (Hydrogen (H), Oxygen (O), Nitrogen (N), and Carbon (C)).</p> <p>Element Groups:</p> <ul style="list-style-type: none"> <li>Alkali Metals</li> <li>Alkaline Earth Metals</li> <li>Transition Metals</li> <li>Other Metals</li> <li>Metalloids</li> <li>Non-Metals</li> <li>Halogens</li> <li>Noble Gases</li> <li>Rare Earth Elements</li> </ul>
<i>Be familiar with principles of light.</i>	<p>Discuss light as a form of energy.</p> <p>Describe types of lighting systems.</p> <p>Examine the light spectrum and note the relative smallness of visible light.</p> <p>Define reflection and refraction.</p> <p>Explain how light carries information (by lasers) and show examples of the impact on technology/industry.</p> <p>Identify types of lenses.</p>
<i>Be familiar with principles of color.</i>	<p>Diagram the main parts of the eye involved in seeing color (rods, cones).</p> <p>Use prisms to split light into the visible spectrum. Briefly explore color blindness. What precautions should colorblind persons take regarding workplace safety?</p>

	Define situations in which colorblindness impacts a worker's ability to do his job.
<b>LIFE SCIENCE</b>	
<i>Explain the presence of cells as the identifier of all living organisms.</i>	<p>Examine the cells of organic material used in your industry, using books, the internet, or a microscope.</p> <p>Recognize that cells divide or replicate to promote growth of an organism.</p> <p>Examine the parts of a cell. Compare the cell to a machine...how do the parts function and rely on each other?</p> <p>Give example of one-celled and multiple-celled organisms.</p> <p>Review the classification system of all organisms (Kingdom, Phylum, etc).</p> <p>Create a circle graph or pie chart (totaling 100%) showing the relationship (in numbers) between the groups of organisms:  Bacteria  Fungi  Viruses  Insects  Plants  Vertebrates  Invertebrates</p> <p>Compare some of the cell processes (active and passive transport) to the processes in your industry.</p>
<i>Understand the progress of evolution of organisms.</i>	Recognize how a species will adapt to better fit in its environment over time.
<i>Explain the role of genetics in human development.</i>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of heredity, including:</p> <ul style="list-style-type: none"> <li>• Half of an individual's genes are contributed by each parent</li> <li>• Traits that are inherited are either dominant or recessive from the parent(s)</li> </ul>

	<ul style="list-style-type: none"> <li>• Cell division by mitosis versus meiosis</li> <li>• Disabilities are caused either by genetic/inherited conditions (such as Down's Syndrome) or in accidents occurring after birth, such as brain damage due to a car accident or a stroke</li> </ul>
<i>Investigate/apply principles of human development.</i>	<p>Describe the life cycle of humans and other animals.</p> <p>Use the concept of human development to explain the need for understanding foundation skills in your area. (For example, children do not run before they walk.) Use this concept to explain other events that occur in a natural order in your industry.</p>
<i>Explore additional concepts pertaining to humans and other animals.</i>	<p>Give examples of ways organisms adapt to their environment.</p> <p>As relating to industry, review the concepts of:</p> <p>Aging Immune system Skin and Tissues Blood and hemoglobin Disease</p>
<i>Compare/contrast the differences between sexual and asexual reproduction.</i>	<p>Determine instances when understanding the concepts of sexual reproduction are important for your industry.</p> <p>Highlight the effects of unsafe working practices on unborn fetuses, or the dangers present for pregnant individuals working in industry.</p>
<i>Show a general understanding of the importance of health.</i>	<p>Explore the cost of lost wages and worker's compensation in the past year due to health problems.</p> <p>Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc)</p>
<i>Investigate the food cycle.</i>	<p>Identify food chains, food webs, food pyramids.</p> <p>Show how changes to the food cycle affect the</p>



	<p>environment and affect man.</p> <p>Name the food groups.</p>
<i>Understand</i> <b>nutrition and the body's need for a diet that provides vitamins and minerals.</b>	<p>Show an understanding of body systems (circulatory, nervous, digestive, etc) as they relate to industry.</p> <p>Identify deficient vitamins and minerals among a particular population (American workers, workers in specific environments, workers who do not go outdoors, or who always work outdoors) and the health risks associated with job types (office work, mining work, etc.)</p>
<i>Observe</i> <b>health code/sanitation requirements.</b>	<p>Research the development of health code and sanitation requirements, including OSHA.</p> <p>Compare/contrast workplaces of 1850, 1900, 1950, 2000 regarding health and safety.</p> <p>Discuss the most common workplace violations of health requirements and present in a graphic format (e.g., maps, charts).</p> <p>Discuss potential effects of ignoring health requirements.</p> <p>After identifying workplace hazards, create several plans to treat the problem. Debate the benefits of each.</p> <p>To avoid the threat of employers choosing ineffective means of ensuring safety on the job, locate MSDS sheets, first aid stations, personal protective equipment, worker's compensation claims offices/paperwork, etc.</p> <p>Using workplace materials*, locate the section on safety regulations. Ask students to rank order the items. Debate the importance of each. Determine the threat of ignoring regulations. Research which regulations are often disregarded.</p> <p>Explore proactive measures students can take to extend their health.</p> <p>Understand the importance of mental health in</p>

	addition to physical health.
<i>Investigate/apply</i> <b>principles of anatomy and physiology.</b>	<p>As relating to your industry, explore issues relating to anatomy and physiology.</p> <p>Skeletal system- study the bones of the arm, hand, and neck. Research carpal-tunnel syndrome.</p> <p>Fractures- identify the types of fractures and those most common to your line of work. Learn how to prevent falls.</p>
<i>Understand</i> <b>basic principles of Ecology.</b>	<p>Define ecology.</p> <p>Identify 5 major ways in which man interacts with the environment, especially as relating to your industry.</p> <p>Discuss the effectiveness of the media as compared to pro-science groups (such as Greenpeace) on the public's awareness of important environmental issues.</p> <p>Identify any areas of concern regarding waste/waste management in your industry.</p> <p>Show the difference between a niche, community, habitat, and ecosystem.</p> <p>Give examples of herbivores, carnivores, and omnivores. How does your industry use and serve each group?</p> <p>Understand predators' effects on food chains. Identify predators of industry.</p> <p>Explain the process of decomposition and decay. How does industry interfere with or interrupt these processes?</p>
<i>State</i> <b>the differences between viruses and bacteria.</b>	<p>Define viruses and bacteria.</p> <p>Explore viral and bacterial threats present in the workplace. How can they be prevented? How can they be treated?</p> <p>State the benefits of viruses and bacteria.</p>

	Explain the recent increased resistance to drugs and antibiotics.
<i>Understand</i> <b>basic concepts relating to plants.</b>	<p>Describe the interchange of oxygen and carbon dioxide between plants. Contrast to the way humans exchange oxygen and carbon dioxide.</p> <p>As relating to industry, review the concepts of:  Fertilization  Parts of plant, and functions of each  Effects of temperature on plants  Need for water and light  Photosynthesis</p>
<b>EARTH SCIENCE</b>	
<i>Recognize</i> <b>earth's position in the universe.</b>	<p>As relating to your industry, identify relevant topics regarding  Asteroids  Comets  Stars  Galaxies</p> <p>Identify planets in the solar system.</p> <p>Compare and contrast earth to other planets.</p> <p>Create a model showing the relative size of earth within our solar system. Use mathematical relationships to make sure the scale is correct (earth is the size of ____ so the sun should be the size of ____).</p> <p>How do the phases of the moon and sun affect the hemispheres?</p>
<b>Investigate history of the earth.</b>	<p>Identify geological, chemical and other methods of determining the age of an object.</p> <p>Demonstrate that fossils and rocks are indicators of previous eras.</p> <p>As a class, create a timeline indicating the age of the earth. Include the various ages (Ice Age, etc) and the length of each.</p> <p>Make sure the timeline is drawn to scale.</p>

	<p>Assign each Age to a group and research the following:</p> <p>Weather</p> <p>Major events at beginning and end of age</p> <p>Organisms living during this time</p> <p>Factors that made the Age unique</p>
<i>Investigate</i> <b>physical characteristics of the earth.</b>	<p>Label/model the components of the earth.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of gravity.</p> <p>Solve problems of longitude, latitude and time zones.</p> <p>Create a model of the ratio of land and water on earth.</p>
<i>Investigate</i> <b>physical forces acting on the earth.</b>	<p>Examine erosion and depletion of nonrenewable resources.</p> <p>Identify natural disasters such as hurricanes and earthquakes. Research the effects of a past disaster on a specific industry.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of plate tectonics (the earth's surface is broken into large plates; movements of these plates over time causes earthquakes and other geologic activity).</p>
<i>Explain</i> <b>the basic components of earth's rotation.</b>	<p>Understand that the earth spins on its axis at an angle of 23 ½ degrees</p> <p>Identify the period of one complete rotation as a day; longer cycles of rotations identify the seasons.</p> <p>Discuss time zones.</p>
<i>Identify</i> <b>the earth's atmosphere and its components.</b>	<p>Identify the main elements in the earth's atmosphere (nitrogen and oxygen).</p> <p>Identify layers of the atmosphere, and the ozone layer.</p>

	Explain concepts of air pressure.
<i>Understand</i> <b>basic principles of the solar system.</b>	Demonstrate how the sun strikes the earth at different angles depending on location.
<i>Demonstrate</i> <b>the relationship between climate and weather.</b>	<p>Identify the factors that create weather.</p> <p>Show how landscape features are affected by changes in climate or weather.</p> <p>Identify the greenhouse effect. How does industry contribute to it?</p> <p>Describe the relationship between altitude and weather.</p> <p>Understand that changes in the weather may be seen as fronts that are put in motion by the jet stream.</p> <p>Identify types of precipitation.</p> <p>Differentiate between types of clouds.</p> <p>Understand the effect of winds, wind speeds, and impacts on vegetation.</p>
<i>Learn and apply</i> <b>concepts relating to the oceans.</b>	<p>Label the major oceans and seas.</p> <p>Determine the elements in ocean water (nearly all elements are present).</p> <p>Identify or draw the structural components of the ocean floor.</p> <p>Explain the relationship between the moon and the tides.</p> <p>Explore ways the ocean is used for power and business.</p>
<i>Investigate</i> <b>principles of water.</b>	<p>Identify the parts of the water cycle and the effects of the processes involved.</p> <p>Define water's chemical properties water is the universal solvent water has a neutral ph of 7</p>

	<p>chemically, water is one atom of oxygen bound to two atoms of hydrogen)</p> <p>Measure salinity. Which industries rely heavily on water?</p> <p>Define water's physical properties  water is the only natural substance that exists as solid, liquid, and gas  water's surface has a high density  water has a high tolerance for heat (heat index)  water's weight  water as a coolant  specific gravity</p>
<i>Investigate conservation of physical and natural resources.</i>	<p>As relating to your industry, discuss or debate the issues of  Allocation of resources  Recovering resources  Best/worst methods of using resources</p> <p>Compare/contrast renewable and nonrenewable resources.</p> <p>Note the important developments in your industry regarding mineral, soil, water, and wildlife conservation.</p> <p>Discuss alternative sources of energy as relating to your industry.</p>
<i>Investigate issues regarding scientific technology.</i>	<p>As relating to your industry, discuss the uses of technology.  What are the newest developments?</p> <p>What effects does the technology have on our society? Political system?</p> <p>Discuss the role of economics on technology.</p>
<i>Apply science principles/laws to environmental issues.</i>	<p>Discuss how mankind alters the earth and environment through use of resources and technology, pollution.</p>

# **Crosswalk to Skills USA/VICA**

## **Technical Drafting**

### **Architectural Drafting**

Skills USA–VICA, the co-curricular student organization for Trade and Industrial Education, provides many opportunities through its program of work for students to apply the knowledge, skills, and processes learned in a variety of courses. A correlation of the Technical and Architectural Drafting contest to selected tasks/competencies in Arkansas’s Drafting and Design courses are provided as a supplement to this framework.

#### **Technical Drafting**

##### **Purpose**

To evaluate each contestant’s preparation for employment and to recognize outstanding students for excellence and professionalism in the field of technical drafting.

##### **Clothing Requirement**

*For men:* Official SkillsUSA white polo shirt with black dress slacks, black socks and black leather shoes.

*For women:* Official SkillsUSA white polo shirt with black dress slacks or skirt, black socks or black or clear seamless hose and black leather shoes. To purchase the polo shirt, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: <http://www.mwtrophy.com/vica/index.html>.

##### **Eligibility**

Open to active SkillsUSA–VICA members enrolled in programs with technical drafting as the occupational objective.

## Equipment

- Supplied by the technical committee:
  - The technical drafting workstation will be equipped with a flat table (approximately 24"x72"), a second table with space for a personal computer and a chair.
  - 110-volt electric outlet
  - One formatted IBM compatible diskette
  - Output hardware — plotter or printer
  - Plotter media
  - Pens. Ink or toner as required
  - Drafting paper/vellum
  - All necessary information and furnishings for judges and technical committees
- Supplied by the contestant:
  - Typical personal drafting equipment and supplies desired for traditional drafting.
  - A personal computer, monitor and input de-vices *or* a laptop computer. Computers may be obtained from any source. To have access to the most current technology, contestants are encouraged to develop a relationship with a hometown computer/software dealer who can serve as a contestant sponsor. Note: Should a national sponsor for computer hardware be secured, all states will be notified prior to the next SkillsUSA Championships.
  - Note: The setup and configuration, and the tear down of all computer hardware used in the contest will be the responsibility of the contestant.
  - Technical software of choice. Photocopies of software licensing for every software program used in the contest must be submitted to the technical committee at the pre-contest meeting.
  - Students may bring published computer-aided drafting reference books, software manuals, published technical drafting reference books, tables and calculators. Reference materials may not take up more than 1 cubic foot of space and may not be shared by contestants.



## Scope of the Contest

- The contest will focus on the solution of the given problems by applying appropriate technical drafting skills to solve visualization and presentation problems of a mechanical nature. The contestants will be required to solve industry-developed problems. It is at the contestant's discretion as to which drafting tools and techniques will be utilized: the technology of Computer-Aided Drafting (CAD), traditional board techniques, or some combination of the two.
  - Contestants will demonstrate their ability to perform technical drafting skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee.
    - Scale usage
    - Sketching
    - Orthographic views
    - Auxiliary views
    - Sectional views
    - Dimensioning and tolerancing including geometric dimensioning and tolerances
    - Detail and assembly drawings
    - Fasteners and hardware
    - Presentation/pictorial drawings
    - Materials and specifications
    - Manufacturing processes
    - Power transmission
    - Sheet metal developments
    - Use of reference materials
    - Computer-generated 3-D models
    - Calculation of mass properties (volume, density, etc.)
  - During the contest, the contestants will work independently. Other contestants, instructors or observers will give no assistance. Limited technical assistance for computer or software malfunction may be given by appropriate manufacturer's representatives..270
- SkillsUSA Championships Technical Standards (2002–2004)*

- Contestants will each be given the same amount of time to accomplish the problem. Everyone will begin at the same time and take the required lunch break, and no one will be allowed to work past the contest conclusion. Note: An exception may be granted at the discretion of the technical committee in an instance where a computer/software malfunction causes a significant time loss that impacts the contestant's performance.
- Each contestant will be responsible for establishing plotting procedures at the computer for plotting their work to a plot file on a floppy disk.
- Judging criteria are general in nature and will be done from some combination of written test, plotted drawings, manual drawings and/or sketches. Specific criteria will be based on the demonstration of competency in those elements of accuracy and productivity included in the contest problem(s). *Sponsored by Goodheart-Willcox Publisher*

#### **ITEMS EVALUATED**

- Written Test
- Problem Solution
- (Specific criteria to be supplied at contest orientation)
- Dimensioning and Notes
- Layout and Presentation of Drawing(s)
- CLOTHING PENALTY (minus 0 to 5 percent of total points)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee..272 *SkillsUSA Championships Technical Standards (2002–2004)*.  
*Sponsored by Goodheart-Willcox Publisher 273*

## **Architectural Drafting**

### **Purpose**

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of architectural drafting.

## **Clothing Requirement**

*For men:* Official white polo shirt with black dress slacks, black socks and black leather shoes.

*For women:* Official white polo shirt with black dress slacks or skirt, black socks or black or clear seamless hose and black leather shoes. To purchase the polo shirt, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: <http://www.mwtrophy.com/vica/index.html>.

## **Eligibility**

Open to active SkillsUSA members enrolled in programs with architectural drafting as the occupational objective.

## **Equipment**

- Supplied by the technical committee:
  - The architectural drafting workstation will be equipped with a standard drafting table, a Vemco drafting machine, a work area for reference material, a space for a personal computer and a chair.
  - 110-volt electrical outlet
  - One formatted IBM-compatible diskette
  - Output hardware—plotter or printer
  - Drafting paper/vellum
  - All necessary information and furnishings for judges and technical committees
- Supplied by the contestant:
  - Unless a national sponsor has been secured, the contestant will be required to provide his or her own PC-type computer, monitor and input devices. Computers may be obtained from any source. To have access to the most current technology, contestants and their schools are encouraged to develop a relationship with a hometown computer/software dealer who can serve as a contestant sponsor. Note: Should a national sponsor be secured, all states will be notified prior to the next SkillsUSA Championships.

- Architectural software of choice. Proof of licensing for every software program installed on the contestant's computer must be provided to technical committee at pre-contest meeting.
- Students may bring published CAD drafting reference books, tables and software manuals. Reference materials must not take up more than 1 /2 cubic foot of space and may not be shared between contestants.
- Students may bring published board drafting reference books and tables. Reference materials must not take up more than 1 /2 cubic foot of space and may not be shared between contestants. Note: Total volume of reference material may not exceed 1 cubic foot.
- Typical personal drafting supplies desired for board drafting subject to the approval of the technical committee.
- Battery-operated calculator Note: The setup configuration and the tear down of all contestant-provided equipment will be the responsibility of the contestant.

### **Scope of the Contest**

- The contest will include traditional drafting and computer-aided drafting (CAD) skills. Judging will be based on accuracy and productivity. A written test covering basic skills and knowledge in both traditional drafting and CAD may be given. Contestants will demonstrate their ability to perform both traditional drafting and CAD skills selected from the list of competencies as determined by the SkillsUSA Championships technical committee. Committee membership includes: Archsoft Group, Autodesk Inc., Estopinal Group Inc., Goodheart-Willcox Publisher and J.P. Bauer Associates, P.C. Competencies to be demonstrated may be selected from the following:
  - Presentation of alternative designs
  - Isometric pictorial views
  - Interior perspective views and traffic patterns
  - 4. Exterior perspective views
  - Floor plan with variations
  - Various elevations
  - Landscapes

- Site layouts with grade elevations
  - Basement plan
  - Foundation plan
  - Joist framing plan
  - Roof framing plan
  - Plumbing plan
  - Electrical plan
  - Construction details and plan
  - Complete dimensions
  - Window and door detail
- Preparation of drawings will include proper dimensions and line type selection according to current drafting standards.
  - During the contest, the contestants will work independently. Other contestants, instructors or observers will give no assistance. Limited tech-128 *SkillsUSA Championships Technical Standards (2002–2004)* technical assistance for computer or software malfunction may be given by appropriate manufacturers representatives.
  - Contestants will each be given the same amount of time to accomplish the problem. Everyone will begin at the same time and take the required lunch break, and no one will be allowed to work past the contest conclusion.
  - Each contestant will be responsible for establishing plotting procedures at the computer and for plotting their work to a plot file on a floppy disk.
  - Judging criteria are general in nature and will be done from plotted drawings, manual drawings and sketches. Specific criteria will be based on the demonstration of competency in those elements of accuracy and productivity included in the contest problem. *Sponsored by Goodheart-Willcox Publisher* 129

## **ITEMS EVALUATED**

- Competence in following instructions/solution to problem
- Manual drafting technique
- CAD technique
- Floor plan

- Exterior elevations
- Interior elevations
- Construction details
- Accurate dimensioning and notes
- Layout and balance of presentation
- Site plan
- Written test
- CLOTHING PENALTY (minus 0 to 5 percent of total points)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee..130 *SkillsUSA Championships Technical Standards (2002–2004)*.  
*Sponsored by Goodheart-Willcox Publisher 131*

# Arkansas's All Aspects of Industry

## **Defining “All Aspects”**

All aspects of an industry include, with respect to a particular industry that a student is preparing to enter, planning, management, finance, technical and production skills, underlying principles of technology, labor and community issues, health and safety, and environmental issues related to that industry. Planning is examined at the level of both an individual business and the overall industry. Planning elements might include:

- Developing strategic plans — mission, vision, goals, objectives, and/or a plan of action
- Working with planning tools such as surveys, market research, and competitive analysis
- Anticipating needs for staffing and major purchases of equipment and supplies
- Developing plans for training and upgrading of staff
- Forecasting market trends
- Developing business plans for entrepreneurial ventures.

Management addresses methods typically used to manage enterprises over time within the industry, as well as methods for expanding and diversifying workers' tasks and broadening worker involvement in decisions. Key elements of management might include:

- Using an organization chart to explain how a corporate chain of command works
- Providing input for strategic plans and communicating the company's vision and mission statements
- Leading employees in carrying out strategic plans and action plans
- Evaluating employee performance
- Anticipating technology and other major purchasing needs
- Ensuring equity and access for employees
- Resolving conflicts
- Developing job descriptions and written policies/procedures
- Identifying recruitment procedures, training opportunities, methods of evaluation, and retention strategies

- Working with professional associations and community outreach efforts.

Finance examines ongoing accounting and financial decisions and different methods for raising capital to start or expand enterprises. Finance functions might include:

- Developing budgets
- Preparing financial statements
- Analyzing and managing financial transactions and records
- Implementing payroll procedures
- Determining and paying taxes
- Identifying indirect wage costs (benefits, FICA, insurance, worker's compensation)
- Making loans and granting credit to customers
- Developing graphs and charts related to company finances
- Identifying and implementing methods of sustaining profitability of a business
- Managing 401K plans
- Identifying sources of capital

Technical and Production Skills cover specific production techniques and alternative methods for organizing the production work, including methods that diversify and rotate workers' jobs. Technical and production skills that an employee should have to succeed in a business or industry might include:

- Developing and upgrading job-specific skills
- Using troubleshooting and problem-solving techniques
- Analyzing information to make decisions
- Identifying and implementing quality assurance techniques
- Employing communication skills such as writing, listening, speaking, and reading
- Participating in team efforts
- Implementing projects and new techniques
- Demonstrating basic computer skills; employing time management techniques in completing projects and assigned tasks
- Demonstrating ethical behavior and work ethic.



Underlying Principles of Technology provide an integrated study across the curriculum of the mathematical, scientific, social, and economic principles that underlie the industry's technology.

Principles of technology that an employee should know might be demonstrated by:

- Exhibiting proficiency in mathematical and scientific functions related to new and emerging technologies
- Continuously upgrading job skills needed to implement new technologies
- Participating in industry certification programs
- Cross-training to enhance one's value to the organization and to enhance job promotion opportunities
- Understanding and adhering to ethical issues related to technologies.

Labor Issues examine worker rights and responsibilities, labor unions and labor history, and methods for expanding workers' roles. Labor issues might include:

- Understanding and implementing worker rights and responsibilities
- Working with labor unions
- Keeping abreast of local, state, and federal legislation affecting employee and employer rights and responsibilities
- Negotiating and settling worker disputes
- Identifying certification requirements for specific jobs
- Analyzing the impact of labor agreements on business operations.

Community Issues explore the impact of the industry on the community and the community's impact on and involvement with the industry. Concepts of business and community relations might include:

- Developing and working with community outreach projects
- Participating on advisory committees and community organizations
- Working with professional associations
- Developing and implementing public relations plans
- Participating in community service projects.

Health, Safety, and Environmental Issues examine these concepts in relation to both the workers and the larger community. Concepts related to health, safety, and the environment might include:

- Identifying and implementing federal, state, and local regulations related to the health and safety of employees
- Understanding and strictly adhering to federal, state, and local environmental regulations related to the business
- Identifying job-specific health hazards and safety issues
- Identifying and implementing basic safety and first aid training techniques for emergencies such as personal illness or injury, tornadoes, fires, nuclear accidents, floods, and incidences of employee-rage or violent behavior
- Communicating safety regulations and plans to employees

Working with selected community groups to implement safety programs.

# **ADDA Drafter Certification Test Areas Related Course Task/Competency**

- Object representation

- Orthographic
- Multiview projection
- Sectional views (manufacturing and architecture)
- Primary auxiliary views

Describe various types of drawings.

Prepare orthographic projections.

Prepare sectional views.

Prepare auxiliary views.

Select the appropriate types of projections to represent objects.

Prepare a rendered presentation drawing.

- Pictorial views (specifically, isometric and oblique interpretation)

Describe various types of drawings.

Create pictorial views from orthographic projections.

Prepare a rendered presentation drawing.

- Symbol/term knowledge (on a basic level)

- Apply mechanical symbols to a drawing.

Dimensioning and notes (manufacturing, both nomenclature and convention)

Dimension mechanical drawings.

Use CADD dimensioning commands.

Add general notes to a drawing.

Dimension architectural drawings.

- Sectioning (manufacturing)

Prepare sectional views.

- Welding

Prepare drawings of threads and fasteners.

- Geometric dimensioning and tolerancing

Dimension mechanical drawings.

Prepare drawings of threads and fasteners.

Dimension architectural drawings.

- Manufacturing processes

Add general notes to a drawing.

- Working drawings (manufacturing)

Prepare detail and assembly working drawings.

- Fits and tolerances

Dimension mechanical drawings.

Prepare drawings of threads and fasteners.

Dimension architectural drawings.

- Scales, lettering and lines

Demonstrate techniques of scale usage.

Prepare freehand sketches.

Perform freehand lettering.

Apply line conventions.

- General drafting standards (manufacturing)

- Title blocks

Describe various types of drawings.

Revise existing drawings.

- Face of drawing

Describe various types of drawings.

- Drawing release procedures

Reproduce bluelines.

Prepare a rendered presentation drawing.

Prepare a cover sheet.

- Record keeping

- Reproduction

Reproduce bluelines.

- Typical drafting department procedures

- Basic geometric construction/analysis  
Apply geometric construction principles.